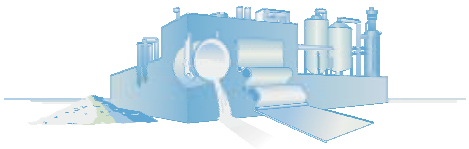
Biological Air Emissions Control

Biological Treatment of Air Emissions Promises Significant Energy and Cost Savings

The U.S. wood products industry is a leader in the production of innovative wood materials. New products are taking shape within a growth industry for fiberboard, particle board, plywood, oriented strand board, and other natural material-based, energy efficient building materials. However, at the same time, air quality standards are becoming more stringent around the Nation. Emissions of volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) during production of wood products (including methanol, formaldehyde, acetylaldehyde, and acrolein) must be tightly controlled.

Conventional VOCs and HAPs emission control techniques such as regenerative thermal oxidation (RTO) and regenerative catalytic oxidation (RCO) require significant amounts of energy and generate secondary pollutants such as nitrogen oxides and excess carbon dioxide. Biological treatment of air emissions offers a cost-effective and sustainable control technology for industrial facilities facing higher air emission standards. A novel biological treatment system that integrates two types of bio-oxidation systems, promises significant energy and cost savings. This novel system uses microorganisms to degrade air toxins without the use of natural gas as fuel or the creation of secondary pollutants.

Field-scale biological air treatment unit at Stimson Lumber Company (Oregon).



Benefits for Our Industry and Our Nation

The replacement of conventional thermal oxidizers with biofilters will yield natural gas savings alone in the range of $100's of thousands to over $1 million per year per unit. Widespread use of biofilters across the entire forest products industry could yield fuel savings up to 5.6 trillion Btu (British thermal units) per year and electricity savings of 2.1 trillion Btu per year. Biological treatment systems will also eliminate the production of NO_x, SO_2, and CO, and greatly reduce CO_2 emissions, when compared to conventional thermal oxidizers.

Applications in Our Nation's Industry

Use of biofilters for VOCs and HAPs emission control will provide the wood products industry with a means to better cost-effectively control air emissions. In addition, their potential use in the pulp and paper industry could also provide significant energy savings.

Project Partners

Texas A&M University-Kingsville
Kingsville, TX

Bio•Reaction Industries LLC
Tualatin, OR

Stimson Lumber Company
Forest Grove, OR

Project Description

The goal of this project is to demonstrate a novel sequential treatment technology that integrates two types of bio-oxidation systems – biotrickling filtration and biofiltration – for controlling forest product facility air emissions. This coupled design can be optimized to maximize the conditions for microbial degradation of VOC vapors. Water entering the biotrickling filter is collected in a sump, monitored for water quality parameters, and recycled back to the biotrickling filter. The biofilter serves as a polishing step to remove more complex organic compounds such as monoterpenes. Recycle water conservation can be achieved based on water quality testing during unit performance evaluations.

Pathways

The objectives of this project will be achieved through (1) optimizing the technology at the bench scale and (2) applying the product at the pilot scale in the field, while (3) developing a mathematical model for the sequential unit which can be used to optimize removal efficiency and minimize costs.

Milestones

- Bench scale system design and setup
- Field unit construction and field testing plan development
- Optimization of biotrickling filter and biofiltration system
- Process modeling
- Optimization of water reuse
- Microbial characterization
- Product marketing and commercialization
- Final report and technical summary

Commercialization

The pilot scale design developed by the team is being implemented and optimized at the Stimson Lumber facility with completion of a final design for installation by the end of the project. Bio•Reaction Industries, with assistance from Texas A&M University-Kingsville and Stimson Lumber, will transfer the technology to the wood products panel board market. Pulp mills may also be a potential market, because they offer unique challenges to conventional pollution prevention strategies for control of HAPs and VOCs along with total reduced sulfur (TRS) emissions.

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A Strong Energy Portfolio for a Strong America

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